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CLEFT PALATE AND
HARE LIP.

BY

W. ARBUTHNOT LANE, M.S., F.R.C.S.,

SURGEON TO GUY'S HOSPITAL, AND SENIOR SURGEON TO THE HOSPITAL FOR SICK CHILDREN,
GREAT ORMOND STREET.



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PREFACE TO SECOND EDITION.

IN this edition I have endeavoured to render my account of the various operative procedures clearer by enlarging the size of the illustrations.

W. ARBUTHNOT LANE.

CAVENDISH SQUARE,

February, 1908.

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CLEFT PALATE AND HARE LIP.

IN order to attain to some precise knowledge of the principles which should guide us in the treatment of cleft palate and hare lip we should first study in detail the factors that influence the growth of the naso-pharynx and of the mouth and of the bones that surround these cavities. *This is most important, since the success which attends these operations, so far as concerns perfection of speech, varies directly with the degree of development of the naso-pharynx and with the freedom of the passage of air through it.* This will place our treatment on a thoroughly scientific basis.

We will consider in the first instance the factors that determine the form of the bones of the face.

The functions of the bones of the face are four in number :

(1) To surround the passages by which air is transmitted to the lungs ;

(2) To sustain the strain exerted by the muscles of mastication and to transmit and diffuse the resistance offered by the crushed food in the forcible approximation of the jaws during its attrition by the teeth. Besides transmitting pressure the teeth exert a considerable influence by occupying space ;

(3) To accommodate the tongue ; and

(4) To surround and protect the eyes.

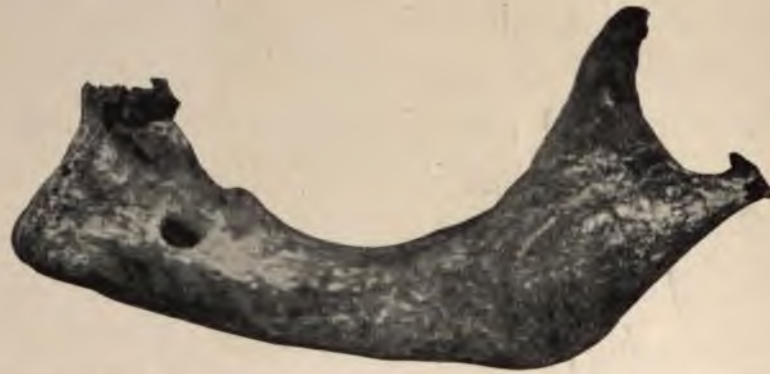


FIG. 1.—Representing the lower jaw of an edentulous old man.

Experiments are made by Nature on all sides showing the influence which the exercise of these several functions exerts upon the skeleton, all capable of accurate measurement and definition.

If an eye be removed early in life, the degree of development of the orbital space and of the eyelids is, after the lapse of several years, less than on the opposite side.

If any of the permanent teeth are lost in young life, or do not erupt, or do so irregularly, the jaw fails to attain to its full size proportionately to the number of teeth absent. If the teeth are lost after the jaw is fully developed the alveoli waste and the bones along which force is distributed either as pres-



FIG. 2.—Showing the condition of a girl, æt. 12, operated upon in 1893. The joint was destroyed when she was 18 months old, and at the operation all trace of it had disappeared completely.

sure or strain become progressively thinner; the rough, prominent surfaces to which the tendinous insertions of muscles are normally attached disappear.

Precisely similar changes take place in the jaw of the edentulous old subject. In extreme instances the character of the temporo-maxillary articulation is

altered. It becomes purely arthrodial in type. Fig. 1 illustrates this condition.

The lower jaw is moulded upon the upper, and anything that interferes with the free movement of these bones on one another impairs their development. Figs. 2, 3, 4, 5, and 6 represent cases of



FIG. 3.—Representing the result of this operation on a boy, æt. 9, in 1892. The jaw was fused to the temporal bone, no evidence of the original joint being visible.

ankylosis of the temporo-maxillary articulation which have been successfully operated upon, the ankylosed joint having been freely excised. They show that the degree of imperfection of the lower jaw varies directly with the duration of the ankylosis and inversely with the age of the child when the destruction of the joint takes place. In these cases this factor

alone—namely, the movements of the jaws and teeth on one another—was in abeyance, since the necessarily very efficient naso-pharyngeal respiration due to the complete apposition of the jaws had developed the naso-pharynx and the surrounding bones as completely as possible in a manner which will now be considered.



FIG. 4.—A boy, æt. 4, who was operated upon in 1894. The joint had been disorganised three years before.

The tongue is an important factor in determining the form of the lower jaw. This is illustrated very well by the disproportionate development of this jaw which is associated with any increase in size of the tongue, often resulting in an “underhung bite” or in “open bite,” conditions familiar to the dental surgeon.



FIG. 5.—A girl, æt. 10, who was operated upon in 1895. The joint was destroyed when the child was 7 years old.



FIG. 6.—An adult whose joint had been disorganised in infancy. The operation was performed in November, 1895, and the illustration represents the condition of the patient in April, 1896. In 1902 her joint was working excellently.

Fig. 7 represents a case which demonstrates in a remarkable and unmistakable manner the mechanical influence which the tongue exerts upon the size of the lower jaw. The patient, a boy, A. B., æt 8 years



FIG. 7.—A. B., showing large syphilitic tongue, which produced underhung jaw and open bite.

and 10 months, was suffering from a gummatous affection of the tongue which had produced a considerable increase in its size. This enlargement had existed for a little more than two years. The organ varied in size with treatment during this period,

but never returned to its original bulk, being always definitely larger than normal. Till this trouble arose in the tongue the child's jaws were apparently normal, but not long after the appearance of the enlargement the boy was noticed to keep his mouth open and to breathe habitually through his nose, and later to have lost all power of biting with the front teeth.

His father had that condition of edge-to-edge bite which results commonly in working men from the habit of holding a clay pipe between the teeth for long periods from early youth. This "jumping of the bite" must be associated with a corresponding change in the temporo-maxillary articulation. The possibilities suggested by it in the treatment of deformities of the lower jaw are considerable.

The boy's superior maxilla is well formed and shows no abnormality, but the lower jaw is relatively much larger than the upper—the basilar portion being particularly well developed—and its outline forms the most striking feature of the child's face.

The usual teeth (viz. the permanent incisors, except the upper right temporary lateral incisor, the six-year molars and the temporary canines and molars in each series) are present; they are on the whole well formed and firmly implanted.

The articulation of the teeth presents a com-

bination of the conditions known as "open bite" and "underhung bite." Regarding the former it need only be said that the back teeth meet quite well, but the upper and lower incisors are separated by about a quarter of an inch at their cutting edges; this, however, is probably partially due to the incomplete eruption of the upper incisors. With reference to the underhung bite, it will be noticed that the



FIG. 8.—Showing A. B.'s "open bite."

lower incisors are in front of the upper incisors instead of behind them, and that all the teeth in the lower jaw bite in front of the corresponding teeth in the superior maxilla; in this case the condition is secondary to the over-development of the whole of the lower jaw and is directly proportionate to it. Fig. 8 shows the several changes described.

Fig. 9 represents a case of underhung bite without the condition of open bite.

The following case affords an excellent illustration of the operative interference a condition of marked deformity may demand for its efficient treatment. The case was one of open bite associated with all the conditions of the upper jaw which result from imperfect development of the naso-pharynx, and with the enlargement of the lower jaw conse-



FIG. 9.—A specimen of underhung bite.

quent on an excessive development of the muscles of the tongue producing an underhung jaw and open bite. The boy was unable to bite his food, his mouth was always open, his lips were consequently thick and everted, and his general appearance was anything but pleasing, while his breath was offensive, and his teeth (especially the lower incisors) and gums were covered with decomposing foodstuffs, &c. The

state of his health was correspondingly unsatisfactory. I would just add that the amount of decomposition and inflammation that go on in the gums and about the teeth in cases of open bite, with the digestive

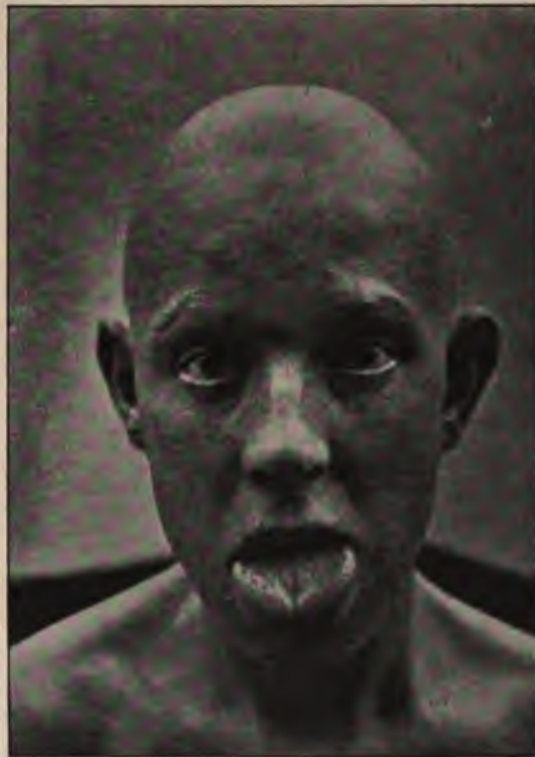


FIG. 10.—Case of open bite operated on, showing large tongue.

disturbance, general depreciation, and often glandular inflammation consequent upon them, are very much greater than in ordinary mouth-breathers from nasal insufficiency alone. This is due to the fact that in the former a large number of teeth cease to perform any biting function, and tartar, &c., collect about

them, while in the latter this is not the case. His mother states that as a young child his jaws and teeth were perfectly normal, and that these deforming changes appeared later in life. Fig. 10 shows his face with the tongue protruded. This, again, is



FIG. 11.—Radiograph of case of open bite.

clearly much larger than normal. Fig. 11 represents a radiograph taken laterally. Fig. 12 shows the plaster casts of the jaws and teeth. In order to remedy the deformity and reduce his masticatory, respiratory, and æsthetic disability to a minimum, careful measurement of plaster casts was made, and experimental sections were made through them to

determine how much bone should be removed in order to obtain the most benefit.

When this had been arrived at I cut away a triangular area from the body of the lower jaw on each side, fastening the fragments securely together with stout virgin silver wire in such a position that



FIG. 12.—Condition of case of open bite before operation.

the front teeth fitted on those of the upper jaw as closely as possible. It was necessary to bring the anterior fragment upwards into a place much above that it originally occupied to meet the receding upper incisors. This photograph of the plaster cast (Fig. 13) shows the present condition. The jaws are now able to perform their normal functions very satisfactorily. The wires were removed later as they gave

rise to inflammation, probably because of the very foul state of the mouth at the time of the operation. In a patient in whom I had displaced the body of the jaw forwards from its normal position I avoided risk of infection by dividing the ramus transversely at the level of the margin of the alveolus, and after bringing the body of the jaw sufficiently far forwards I wired it to the ramus. This could be done in many cases



FIG. 13.—Condition of open bite after operation.

of underhung or ill-developed jaw, but it was not applicable to the case I have described, because of the necessity to do away with the exceedingly deforming open bite.

The teeth in the anterior segment of the lower jaw have been uninfluenced by the section of their nerves and blood-vessels. In cases in which I had previously divided the lower jaw on either side in order to improve the biting capacity or the appear-

ance of the patient, I found that the teeth in the anterior segment apparently suffered no injury. Indeed, in this particular instance the condition of the teeth, as that of the mouth generally and the health of the individual, has been very greatly improved by the absence of the offensive decomposing, pasty material which covered his teeth, resulting from the functional inactivity of certain teeth and from the excessive ventilation of the mouth consequent on the high degree of open bite. Now that he can keep his mouth shut habitually there is no longer the same accumulation of desiccated epithelium and food about the teeth, and the absence of this material and of the toxins thus produced, as well as his capacity to eat his food properly, are responsible for the very marked improvement in his health. His lips have lost their thick, flaccid, everted form, and are now thin, firm, and in apposition, suggesting a higher degree of intelligence than before. The mouth has become correspondingly smaller. The tongue has altered in form owing to the wasting of its anterior portion, which has resulted from the diminution in the size of the bony space accommodating it. It is as broad and thick as it was before, but is very distinctly shorter, and its anterior portion is thinner and more pointed. I would remind you of a condition illus-

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trated by this and other cases of open bite and superior protrusion, and with which you are probably thoroughly familiar, namely, the different behaviour of the upper and lower incisors where their functions are in abeyance. While the lower incisors project upwards beyond their normal level and fan out above the plane of the other teeth, the upper incisors do not reach the normal level. Both form arcs with the concavity open downwards. This condition existed in this boy before operation, but the restoration of the function of the incisor teeth appears to have caused the upper ones to descend somewhat, so as to occupy a better working level.

I will pass on to study the mechanical influence which the passage of air through the naso-pharynx exerts upon its development and upon that of all the bones of the face, and it is quite clear that, under ordinary circumstances, its influence is paramount, being quite out of proportion to that exerted by the factors already referred to.

The chief function of the naso-pharynx is to transmit air into the lungs in order that the sensitive surface of its mucous covering may become affected by substances contained in it. In other words, this part of the body is constructed essentially for the purpose of smell, and in the several groups of animals

the degree of its development varies with the importance of the sense of smell to each. The upper portion of the nasal cavities is used for the ramifications of the olfactory nerve, and the current of air is distributed especially over this area by the act of sniffing. During the normal process of respiration the mouth is kept shut, the upper lip covering the



FIG. 14.—A vertical transverse section through the nasal cavities and adjacent structures.

upper incisor teeth and projecting below them. The breathing air passes chiefly through the lower meatus, while there is hardly any current in the upper part of the space. It is therefore obvious that anything interfering sufficiently with the calibre of the lower part of the nasal cavities impairs their capacity for transmitting air to an extent to make it necessary to keep the mouth open while breathing. When this is

done air enters so freely through the larger and more direct channel formed by the mouth that it ceases to pass through the nose either during inspiration or expiration, the most important part of the function is lost, and the forces which act upon it normally and develop it are in abeyance.

Fig. 14, representing a vertical transverse section through the nasal cavities and surrounding structures

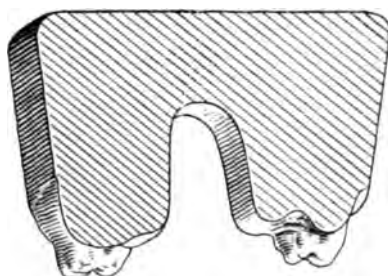


FIG. 15.—A transverse vertical section of the palate and alveolus, life size, of an adult with an imperfectly developed naso-pharynx. The model was made by Mr. Edgar Ashby.

in the normal subject, shows how the calibre of the lower part of the nasal cavities, or of their respiratory section, if I may so describe it, is enormously encroached upon by any ascent of the hard palate above the normal level, and that the air-transmitting capacity of the naso-pharynx varies inversely with the height of the palate; also that the calibre of the entire nasal space is very much affected by the slightest variation in the interval between the septum

and the structures forming the outer wall of the space, such as is necessarily associated with any cramping of the alveolar arch laterally.

Such cases of imperfect development of the nasal cavity are exceedingly common, of which Fig. 15 is an excellent example.



FIG. 16.—A profile of a case of "superior protrusion" resulting from imperfect development of the naso-pharynx.

It behoves us to consider very carefully the factors which are responsible for these conditions of imperfect development, in order that by early and prompt treatment we may save our patients from innumerable complications, some of which may not at first sight seem to depend directly upon it. I believe that they result solely from the fact that for some reason or other the mechanical factor that

affects the development of the naso-pharynx is in abeyance, and that in consequence this space does not enlarge as it should.

The upper jaw of an infant which was born without any anterior nares shows the high palate associated with congenital imperfect development of



FIG. 17.—Case of superior protrusion.

the nasal cavities. Here the association is unmistakable and the causal relationship obvious. Putting it in other words, this case illustrates the general law, namely, "the height of the palate varies inversely as the development of the naso-pharynx." An examination of many casts shows the commencement of the formation of the high palate in con-

sequence of an acquired imperfect development of the naso-pharynx because of respiratory incapacity and local infection.

The large majority of the conditions known to dental surgeons as "superior protrusion" (see Figs. 16, 17, 18 and 19) result primarily from deficient development of the naso-pharynx producing an



FIG. 18.—A profile of a similar case with the jaws apart.

alteration in the form of the upper jaw. This is exaggerated by a want of development of the lower jaw which is found so frequently present, especially in females. It could presumably have been avoided by developing the tongue in early life by such exercise of that organ as could have been afforded by suitable food, the use of chewing gum, etc. This is readily demonstrated by the

fact that the small tongue and lower jaw are so much more common in the girl than in the boy, who is usually much less under control and eats what he pleases. While the girl with an ill-developed nasopharynx has generally a small tongue and a correspondingly small lower jaw, whose teeth bite well behind the normal in the upper jaw, constituting a more or less high degree of superior protrusion, in



FIG. 19.—Showing superior protrusion, with developed naso-pharynx and small lower jaw and tongue, from a girl, æt. 14.

the case of the boy, although the upper jaw shows the same imperfect development, the tongue and lower jaw are often relatively large, the teeth of the lower biting even in front of the normal on the upper, so obviating the superior protrusion as it exists in the girl. On the other hand, the greater development of the tongue in the boy is more likely to result in edge-to-edge bite, underhung bite, and open bite.

Crowding of the teeth is frequently present in the form of upper jaw associated with imperfect development of the naso-pharynx.

Crowding or irregular arrangement of the teeth arises from an imperfect development of the length of the alveolar arches; to obviate this dental abnormality one should strive to attend to those mechanical factors upon which the perfect development of the jaws depend.

The less common variety of superior protrusion, in which the deformity is brought about, not by any imperfect development of the upper jaw due to a deficient naso-pharynx, but merely by an imperfect or atrophic condition of the tongue and lower jaw, illustrates very well the importance of the tongue as a factor in determining the degree of development of the mandible. This variety is most commonly seen in the female, and though in the large majority of cases it is acquired, it is occasionally present at birth, probably as a transmitted condition. This deformity also shows how the alveolar arrangement of the upper jaw is dependent to a certain extent on that of the lower. This cast, obtained from a girl, illustrates fairly well this type of superior protrusion. The naso-pharynx was well developed and the arch of the palate was not abnormally high. The lower jaw

and tongue were relatively small. I believe that the defective development of the lower jaw in this class of case has resulted solely from the deficiency in bulk of the tongue, which has not been sufficiently exercised by suction and mastication during the earlier years of life. It seems to me that if this factor had been considered during the growth of the child we



FIG. 20.—Case of superior protrusion due to deficient development of tongue and lower jaw. Palate not abnormally high; naso-pharynx well developed. Female.

would have here, instead of this condition, a normal bite and jaws that would correspond exactly in size. See Figs. 19 and 20. These represent the fairly common type of jaw of the civilised woman of the present day who has not suffered from any chronic naso-pharyngeal obstruction. In this form of superior protrusion the teeth in the upper jaw are usually regular, while the incisors of the lower jaw frequently overlap one another and incline backwards.

These facts and the best means by which the mechanical principles involved in the development of the bones of the face can be applied should be defined clearly by dental surgeons, and placed in the hands of those who have to deal with young children, and their extreme importance should be impressed on them. This cannot always be done completely by a study of the mouth alone, but must be supplemented by a thorough knowledge of the medical history of their patients. So many dental surgeons are highly-qualified medical men that they have ample means and opportunities for doing this. They will then be in a position to help the medical profession by calling attention to the principles involved in the development of the jaws and of their deformities and to the mode in which the details of preventive treatment based on them must be carried out. Not only does very much of the future comfort of the individual and often freedom from disease depend on the perfect development of the naso-pharynx and jaws, but the financial and other prospects do so also in so far as they are influenced by personal appearance.

An interesting and ready means is afforded, by the study of such imperfectly developed conditions, of determining how quickly a deformity acquired by the parent may appear in the offspring. Personally,

I believe that the transmission of this particular condition is very direct and rapid. The primary factor in producing respiratory capacity is the imperfect nutrition of the child from derangement of the gastrointestinal tract, with consequent mal-assimilation : this I have referred to fully elsewhere.¹ In the young subject the mucous membrane of the nasal cavities is peculiarly liable to inflammations, being usually the area of least resistance, and this inability to resist varies inversely with the respiratory capacity of the individual. The inflammatory swelling of the mucous membrane and the presence of mucus interfere sufficiently with the entry of air during inspiration to make it necessary to breathe through the mouth.

Take some of those children who suffer from these attacks, and observe them carefully. As they stand they assume the "symmetrical posture of rest," which is shown very well in Figs. 21, 22 and 23. The chest is flattened in front, depressed, and the abdomen is thrown forward ; the dorsal spine is flexed, the shoulders project forwards, and the lower angles of the scapulæ are prominent on the back of the chest. To this condition the term "dorsal excurvation" is applied by the profession and that of "round shoulders" by the public. If the child is standing at rest on one

¹ 'Operative Treatment of Chronic Constipation.'

leg the trunk assumes the position which I have described as the "asymmetrical resting posture."



FIG. 21.—Symmetrical posture of rest.

This, from its habitual assumption, may have become fixed and later exaggerated. By the profession this is described as "scoliosis" or "lateral curvature,"

while the public, being most struck with the prominence of the right scapula, regard it as "growing out



FIG. 22.—Symmetrical posture of rest.

of the shoulder." It may be fixed or exaggerated if the period during which it has been assumed is of

sufficiently long duration. Respiration is superficial, rapid and entirely diaphragmatic.



FIG. 23.—Symmetrical posture of rest.

The skin of the chest is opaque and white, and is marked by large, conspicuous, dark-coloured

veins in which the circulation appears stagnant. On looking at the back the skin is seen to be covered over a varying area by a fine down which extends beyond the middle line and becomes continuous above with the hair of the scalp. The margin of the hairy scalp is equally ill defined in front, encroaching often to a considerable extent on the forehead and on the cheeks in front of the ears. Again, the feet are retained usually in a position of abduction, including between their inner margins a considerable angle. This position of the feet may after a time become fixed and later exaggerated. This I showed to be merely the habitual assumption by the foot of the "position of rest" or of abduction, but by the profession and the public it is spoken of as "flat foot." The condition of knock-knee, or a diminution of the normal external femoro-tibial angle, is not infrequently seen in a slight degree, due to the habitual assumption of the resting erect posture, whether symmetrical or asymmetrical, but especially the latter. During the time the position is being assumed most of the superjacent weight falls outside the knee-joint, so that the outer part of the epiphysial line is exposed constantly to a much greater pressure than that sustained by the inner segment. In consequence, a correspondingly smaller

amount of bone is formed by the outer part than by the inner, the femoro-tibial angle decreasing proportionately. This general law I formulated in the following words: "The several parts of a growing line form bone at a rate inversely proportionate to the pressure which they transmit." And one might add to this that these conditions are exaggerated in proportion as the nutrition of the osseous system is impaired, as, for instance, in rickets and the excessive growth which ensues in the skeleton in prolonged recumbency. The head is thrown forward (see Figs. 23, 24, and 25) because of the flexion of the dorsal spine, which is of necessity associated with expiration, flexion and extension of the spinal column being, as I explained, the most conspicuous of the thoracic-respiratory processes, and produced chiefly by the action of the intercostal muscles, the internal being the most powerful but indirect extensors of the dorsal spine, and the external the most powerful flexors. They exert their action upon the vertebræ through the ribs. Those muscles are associated in their action with such portions of the internal and external abdominal oblique the fibres of which continue their directions.

The mouth is small in proportion to the deficiency in the development of the jaws and naso-

pharynx. It is kept open, and more or less of the upper incisor teeth is seen. In some cases even the gum may be exposed. The nose immediately above



FIG. 24.—Symmetrical posture of rest.

the lower lateral cartilages is compressed laterally, and little or no movement can be observed in the narrow slit-like anterior nares during respiration.

The nose is frequently tip-tilted, so that its under-surface looks somewhat forward. On either side of the nose the face below the orbit is hollowed, the



FIG. 25.—Symmetrical posture of rest.

normal rounded prominence of the part being wanting. Owing to the interference with the development of the septum, consequent on the imperfect

descent of the palate, deflections of this structure and the formation of "spurs" upon it are frequently very marked features, and, with their immediate neighbour, the inferior turbinate bone, may call for surgical treatment, in some instances with the greatest possible benefit to those adult patients whose nasal



FIG. 26.—From a case of imperfect development of the naso-pharynx.

breathing space is so rendered very much less than normal and correspondingly insufficient.

The width of the face forming the cheeks is less than normal, the malars being flattened and the whole face becoming wedge-shaped. These changes are particularly noticeable in Fig. 27. The alveolar arch of the upper jaw is compressed laterally and the

upper jaw results in its elongation in an antero-posterior direction, in which case the upper incisors project forwards considerably beyond the lower, constituting the "superior protrusion" of dentistry. Or this forward protrusion may be obviated by a corresponding amount of irregularity of the teeth. If a large number of models of cases of superior protrusion be examined it will be found that with very few exceptions the condition is consequent on imperfect development of the naso-pharynx (see Figs. 15 and 16). The width of the alveolar arch of the lower jaws bears a direct relation to that of the upper, upon which it is moulded in its development. The faucial tonsils are probably large, as is also the pharyngeal tonsil. There may be a variable amount of deafness owing to imperfect aeration of the middle ear, to obstruction to the exit of mucus from it, or to interference with the function of the Eustachian tube.

There is often a chronic snuffly cold in the head, with perhaps some irritation of the anterior nares and not infrequently of the upper lip also. The muscles of such children are usually soft and flaccid and their degree of intelligence is very variable. Sometimes they are considered dull and stupid, while others, on the contrary, are said to be very intelligent. This, I take it, varies with the state of the nutrition of the

brain and with the variety of the demands made upon it. If the child uses up its limited brain power in muscular exertion, its capacity to make intellectual effort is small; while if the same energy is employed intellectually under pressure, that to spare for the muscles is correspondingly decreased.

From the consideration of these facts the indications for the treatment of the sufferers from respiratory incapacity and its consequences seem to be as follows. First, we must endeavour to increase the vital capacity of the sufferers by teaching them how to breathe properly and efficiently. To do this the demand on the expenditure of energy should at first be reduced to the minimum requisite to fill and empty the chest to its utmost, avoiding any exercise of the muscles which does not bear directly in bringing this about. In this manner as much energy as possible is accumulated at a minimum of cost to the total energy or capacity for work of the individual.

Secondly, the mouth must be kept shut habitually, and certainly during the respiratory exercises air must be driven freely and forcibly in and out through the naso-pharynx alone. If any mucus exists in the nasal passages, it must be cleared by blowing the nose vigorously. If this treatment is pursued efficiently and thoroughly, the nasal catarrh is removed as well

as the irritation and hypertrophy of the lymphatic tissues in the pharynx, and there is increase of the lumen of the naso-pharynx with the bony and other structures directly dependent on its development for their complete evolution. The rate at which this result is obtained varies inversely with the chronicity of the condition and with the age of the child. The form of the alveolar arches and of the palate alters, the arch opening out in either case. The change in form which the whole face undergoes in consequence of the increase in size of the naso-pharynx and the cavities communicating with it is in some cases most remarkable, attracting at once the attention of those who have not seen the patient in the interval during which the treatment has been adopted.

When, as in cleft palate, the septum between the naso-pharynx and the mouth is incomplete, the mechanical factor upon which the nasal cavities depend for their development is in abeyance, and therefore they do not increase proportionately in size. In consequence the sides of the alveolar arch become approximated, as do the edges of the cleft, and the portions of the roof on either side become more vertical and extensive. I will call particular attention to this, since it will be found that many surgeons use as an argument in favour of delaying

which is occasioned. It is well, therefore, to be prepared for the fact that the closure of the cleft in no way remedies the defect of articulation. Of prime importance is the question, At what age should the operation be performed? It may, I think, be laid down that whilst it is never wise to operate on a child under three years of age, the time of election is from this age up to six years." These definite statements, which are picked out from the text, we may regard as representing generally accepted views and as open to our criticism. The author does not appear to adduce any argument in support of the first statement—viz., that surgeons are acting wisely in avoiding operations in infants; therefore, we may satisfy ourselves by merely asserting that, in our opinion, this statement is not borne out by our experience, but that the reverse is true. The second statement is, I fancy, partly correct. Some patients will, however, complain more of the discomfort which they experience through food getting into the nose than from the consciousness of the fact that their voice differs from the normal. The chief disadvantage of the deformity depends upon whether it is regarded from the point of view of physical discomfort to the sufferers or of depreciation of them in the opinion of their fellow-creatures, since the

three years of age the time of election is from the age up to six years." If we allow the second and third statements to be true, as they are approximately so, it is difficult for the ordinary mind to grasp the logical sequence of the conclusion deduced from them. The treatment of cleft palate, like the greater part of surgery, has been a matter of creed and tradition and has not been arrived at in any reasonable manner. In order to treat these cases as efficiently as possible no time whatever should be lost in restoring to the nose its normal physiology, or, in other words, in giving back to it the mechanical factor which alone determines its development and that of the other structures dependent on it to a considerable extent for their normal form.

Among infants, the subjects of cleft palate, whose condition is unrelieved by operation, the mortality is heavy, while the improvement which takes place in the general condition after operation is most striking.

There are next for consideration the following questions—viz.: 1. What is the best age for operation? 2. What is the best method of performing the operation? 3. How and when can any complication such as hare lip be met to the greatest advantage?

This method has now been largely replaced by the subcutaneous injection of the saline solution.

The case was described in the 'Lancet' of September 12th, 1891, p. 626, under the heading of "A Surgical Tribute to the late Dr. Wooldridge." There had been published in the 'Transactions of the Obstetrical Society of London' for the year 1879 the report of an investigation on transfusion carried out at the request of that Society by Professor Schäfer in which he asserted that the intravenous injection of saline solutions served no useful purpose whatever and insisted that it should not be employed. Needless to say, the researches made by Dr. Wooldridge completely negatived the conclusion arrived at in the report. The following are Professor Schäfer's own words (p. 333): "Solution of salt, and any other watery fluid, is without permanent benefit and should never be used for transfusion."

As I tapped a perfectly new source I was inundated with material, the mothers being delighted to have the deformity removed as early in life as possible. It now seems almost impossible to look back to the time when clefts in the palate in children of three years old and upwards were closed with large clumsy needles of various shapes attached to long handles and called cleft-palate needles.

filled in by a soft elastic curtain made up of opposing layers of mucous membrane and submucous tissue.

The continuity of the muscle planes is unimpaired, no cicatricial tissue exists in their substance, no loss of function arises in any part in consequence, and the muscles on both sides are connected by material on which they can exert efficiently their traction normally in their several directions.

How this is effected in any particular case must depend on the conditions present, such as the age of the child, the presence or absence of hare lip, the shape and extent of the cleft, the state of dentition, and the thickness of the soft parts along the edge of the cleft. I need hardly say that this method of operating is incomparably superior to the usual methods of paring the edges of the cleft and bringing them together. If hare lip exists, the cleft or clefts in it are closed at the same time as the cleft in the palate. This is done for three reasons. The first and most important is that the soft parts which are removed necessarily from the margins of the lip may be of the greatest service in completing the closure of the anterior part of the cleft. Indeed, to one unfamiliar with the employment of these portions of the lip in this manner the large area of cleft which the pieces of lip can be

made to close is most striking. They have a remarkable vitality, and bear an extraordinary amount of handling and suturing with safety.

The second reason is that I find that postponing the hare lip operation for a time reduces the chances of union.

The third reason is that the sooner the pressure of the complete lip is brought to bear upon the segments of the upper jaw as well as upon a displaced premaxilla, should it exist, the more rapid is the approximation of the bones forming the front of the cleft and the restoration of the premaxilla to its normal relationship. The muco-periosteum covering the premaxilla is also useful in helping to close the cleft.

In no circumstances do I ever remove the premaxilla or perform any cutting operation on the septum with a view of displacing the premaxilla backwards. The pressure which is exerted upon the premaxilla by the lip after its continuity has been effected is quite sufficient to bring about its backward displacement, it being forced gradually into the interval between the two maxillæ. This takes place with rapidity. Later the tip of the nose is gradually forced forwards by the growth of the septum.

Practically the flap formation employed to close

in the hard and soft palate resolves itself into two methods. If the soft parts overlying the edges of the cleft are thick and vascular a flap is cut from the mucous membrane, submucous tissue and periosteum of one side, having its attachment or base along the free margin of the cleft. The palatine vascular supply is divided while the flap is being reflected inwards, and it depends for its blood supply on vessels entering its attached margin.

The mucous membrane, submucous tissue, and periosteum are raised from the opposing margin of the cleft by an elevator, an incision being made along the length of the edge of the cleft.

The reflected flap with its scanty supply of blood derived from small vessels in its attached margin is then placed beneath the elevated flap, whose blood supply is ample, and it is fixed in position by a double row of sutures. In this manner two extensive raw surfaces well supplied with blood and uninfluenced by any tension whatever are retained in accurate apposition.

If, on the other hand, the cleft is too broad to admit of its safe and perfect closure in this manner, one flap comprising all the mucous membrane, submucous tissue and periosteum on one side is raised except at the point of entry of the posterior palatine

opposing surfaces are carefully serrated to insure a secure grip upon the needle. An aluminium handle is preferable because of its lightness.

Fig. 29.—Needles in three sizes.

Fig. 30.—Knife which is generally useful.

Fig. 31.—A gag with sharp teeth which bite into



FIG. 30.

the gum and will not slip. In Fig. 34 a pair of gags are shown in position, the tongue being drawn forwards by a ligature.

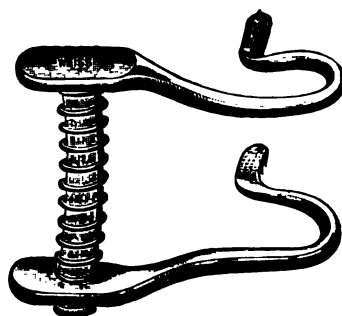


FIG. 31.

Fig. 32.—Dissecting forceps with terminal teeth and approximating serrated surfaces which can grip the needle and pull it through the flap or hold flap or suture securely.

Fig. 33.—Strong compression forceps for controlling the palatine vessels.

by which the principles I have laid down for the closure of clefts are applied.

In Fig. 35 I have attempted to indicate diagrammatically the details of the first method I have described. It is intended to represent the roof of the mouth of an infant, showing a broad cleft involving almost the entire palate. The position of the alveolus

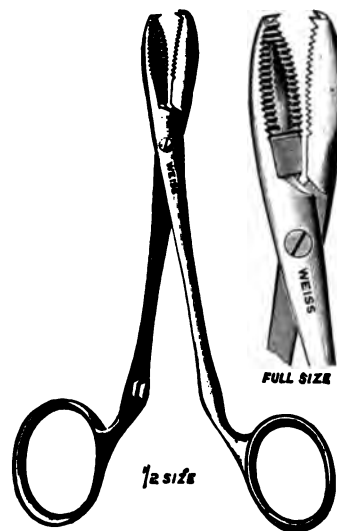


FIG. 33.

is indicated by the three crosses X X X. 1 represents the incision which extends forwards and outwards through the muco-periosteum from the anterior limit of the cleft, and which passes over and beyond the alveolus to its outer surface ; while 2 commences at its outer limit and runs back along the outer surface of the gums about the junction of the cheek



FIG. 34.—Pair of gags shown in position, the tongue being drawn forwards by a ligature giving full access to the cleft in its entire length.

and alveolus. An incision 3 is then made from its posterior extremity along the free margin of the palate

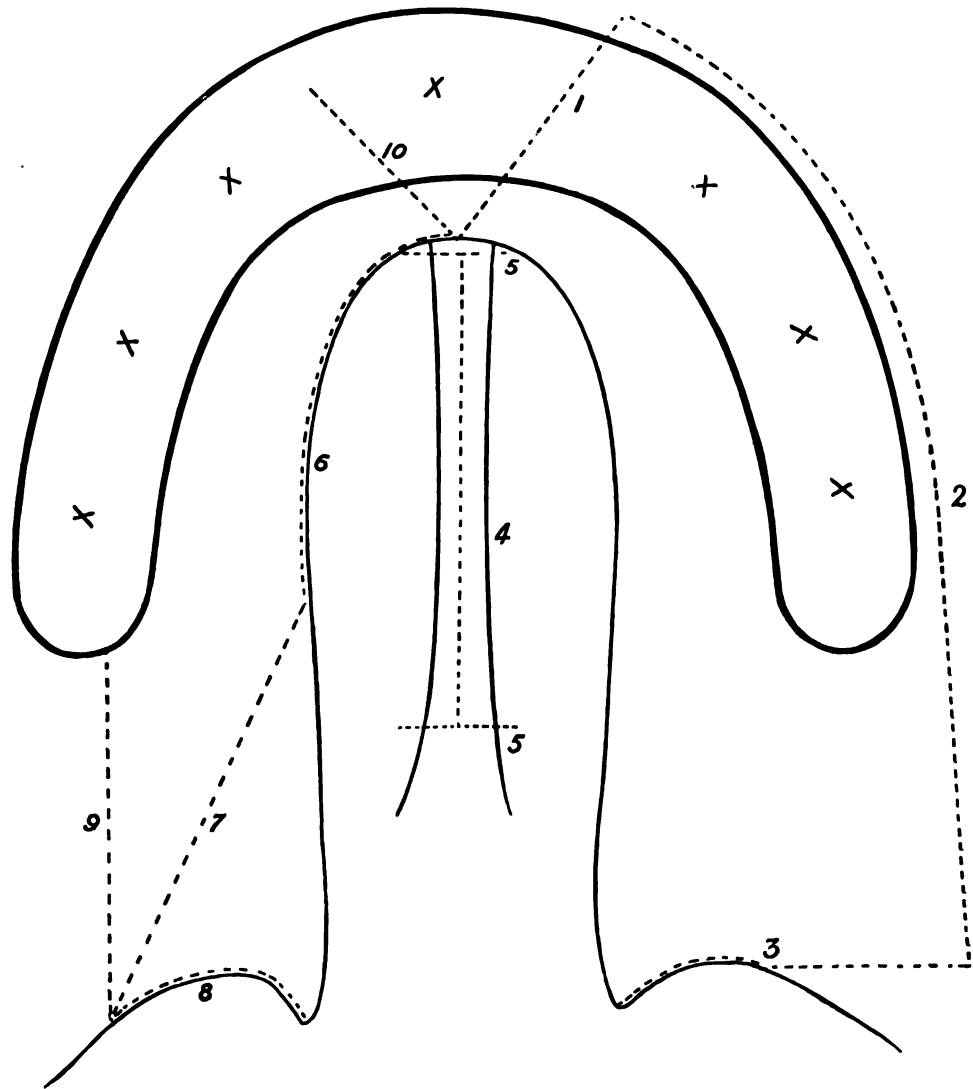


FIG. 35.—Incisions and flaps for broad cleft.

to the uvula. The flap included between these incisions is raised from the subjacent structures, a

pecially designed small knife, or a carefully constructed pair of sharp-pointed scissors being used for the purpose. As the posterior palatine foramen is approached, an elevator pressed in between the flap and the bony palate causes the posterior palatine vessels and nerves to protrude for a considerable length in a tube of periosteum. This is readily grasped by a pair of efficient compression forceps and divided beyond. I particularly use the term "efficient" compression forceps, since almost all those made are only of use to control hæmorrhage while they are attached. A forceps to be efficient should exert on the structures compressed between the blades a pressure sufficient to control the bleeding on its removal (Fig. 33). An instrument effecting this purpose has been made for me. It is furnished with terminal teeth which are of immense advantage in the general use of the forceps, for the reason that the points on the surface on which the teeth impinge are caught by them, and the whole of the soft parts intervening between the points of primary contact is drawn up between the blades. After using these forceps, the ordinary smooth-nosed Spencer Wells forceps seem a hopelessly clumsy and useless implement.

It happens not uncommonly in the type of cleft-

palate illustrated by Fig. 35 that the septum presents a free margin which extends almost, if not quite, to the level of the cleft. In these cases I make an incision (4) through the mucous membrane and periosteum or perichondrium along the middle line of the septum with two small transverse incisions (5) at either end, and turn down laterally the narrow flaps so formed, leaving the cartilage or bone bared and exposed. By placing the flap, which has been raised in position, the line along which it will rest on the septal margin can be readily defined. With a sharp knife the surface of the reflected flap is denuded of its covering of mucous membrane along the area of impact. By a series of sutures perforating the superjacent flap and the margin of the septum if it be not too hard, or the flaps of mucoperiosteum if the edge be bony, the reflected flap is pinned securely to the septum. 6 shows the incision along the free margin of the cleft continued as 7, obliquely outwards and backwards along the upper surface of the soft palate. The incision 8 extends from the posterior limit of 7 along the lower free margin of the soft palate to the tip of the uvula, and the incision 10 forwards and outwards from the anterior limit of 6 on to the alveolus. This last incision facilitates the raising of the flap on this side, and of

the introduction beneath it of the reflected flap from

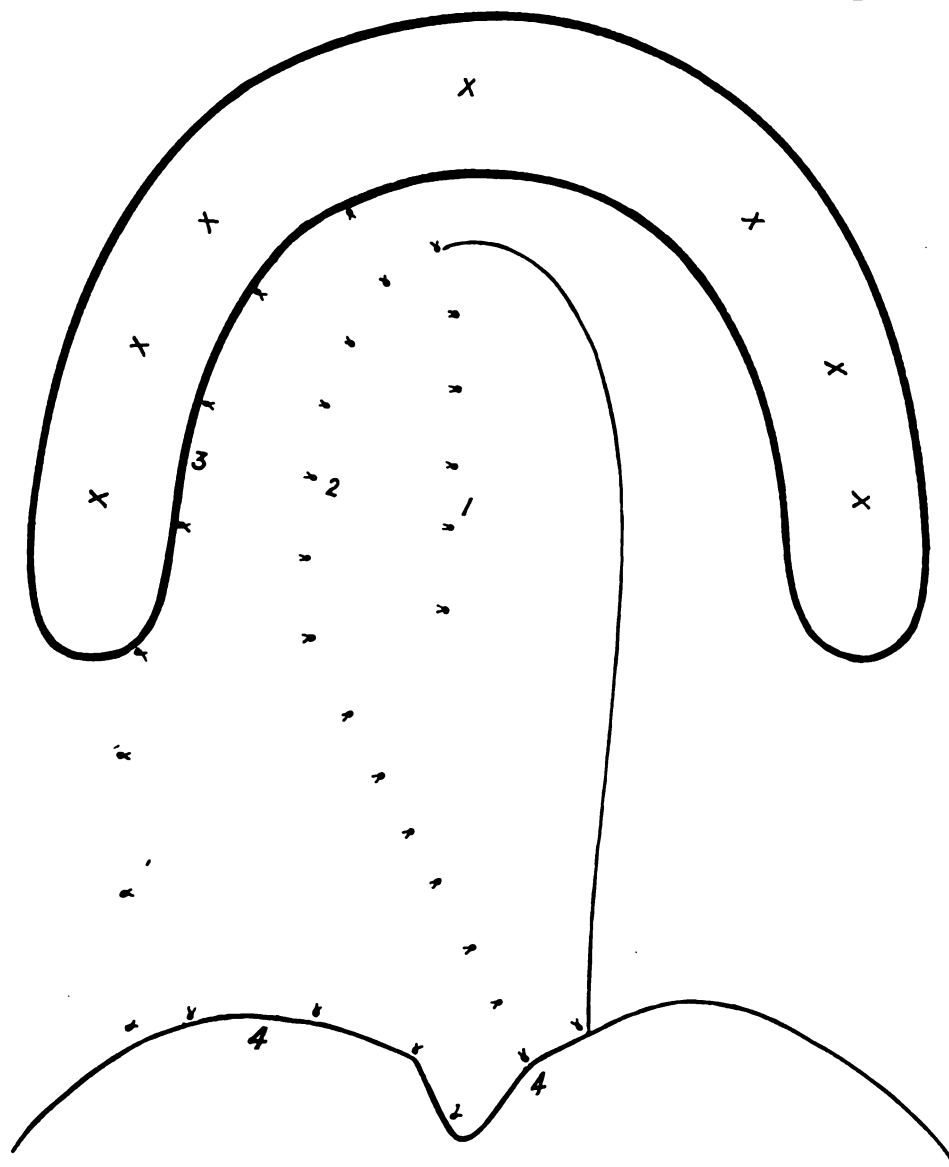


FIG. 36.—Flaps in position.

the opposite side. After the muco-periosteum external to the incision 6 has been raised from the bone,

the soft palate is freed from the posterior margin of the hard palate, and the mucous membrane on its upper surface turned outwards to the position of 9.

In Fig. 36 the flaps are shown in position. The sutures along the line 1 represent those attaching the septum to the reflected flap. Those along 2 show the sutures which unite the free edge of the raised flap to the under surface of the reflected flap; those along the line 3 anchor the edge of the reflected flap,

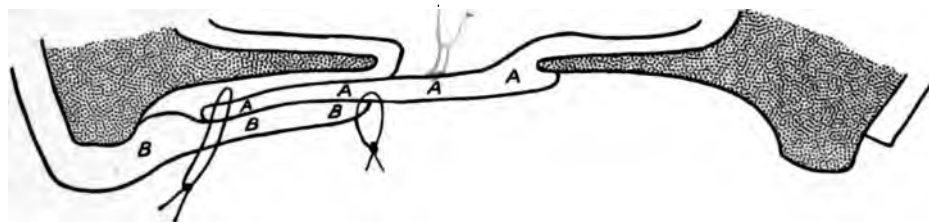


FIG. 37.

and those along the line 4 connect the flaps where they form the free margin of the new soft palate.

In Fig. 37 is illustrated the method of fixation of the reflected A A A A beneath the elevated flap B B B. The left portion of the diagram shows the flap raised from the bone through an incision along the free margin of the cleft, while fixed to it by a double row of sutures is the reflected flap, which has been separated from the roof through a marginal incision along the outer aspect of the gum.

It would be impossible to perform such an opera-

tion with the large, clumsy, coarse instruments in general use which are called cleft palate needles, since they would tear the flaps to pieces, but it can be done readily and skilfully by means of the little needles and needle-holder I devised for the purpose. The gags which I have found most efficient I devised when I commenced these operations, as none of those in use at the time were effective, being all too large and clumsy and insecure. They have teeth, which bite into the gum, to which they are attached most securely, and they are easily removed. The plates carrying these teeth are very small, occupy very little space, and do not get in the way of the operator. These gags are made in pairs and in several sizes.

Another common type of cleft palate in which the same method is frequently applicable is that illustrated in Fig. 38. The cleft in the hard palate is to one side of the mesial line, where the septum is formed continuous with the margin of the cleft. The cleft in the soft palate is much broader, owing to its inclination towards the side containing the septum.

The alveolus, which is cleft also, is represented by three crosses—X X X. The reflected flap is obtained from the segment of roof, shown in the left portion of the diagram, by an incision extending from 7 to 5 to 6 to 8. The mucous membrane, submucous

tissue, and periosteum are raised from the bone and aponeurosis of the soft palate.

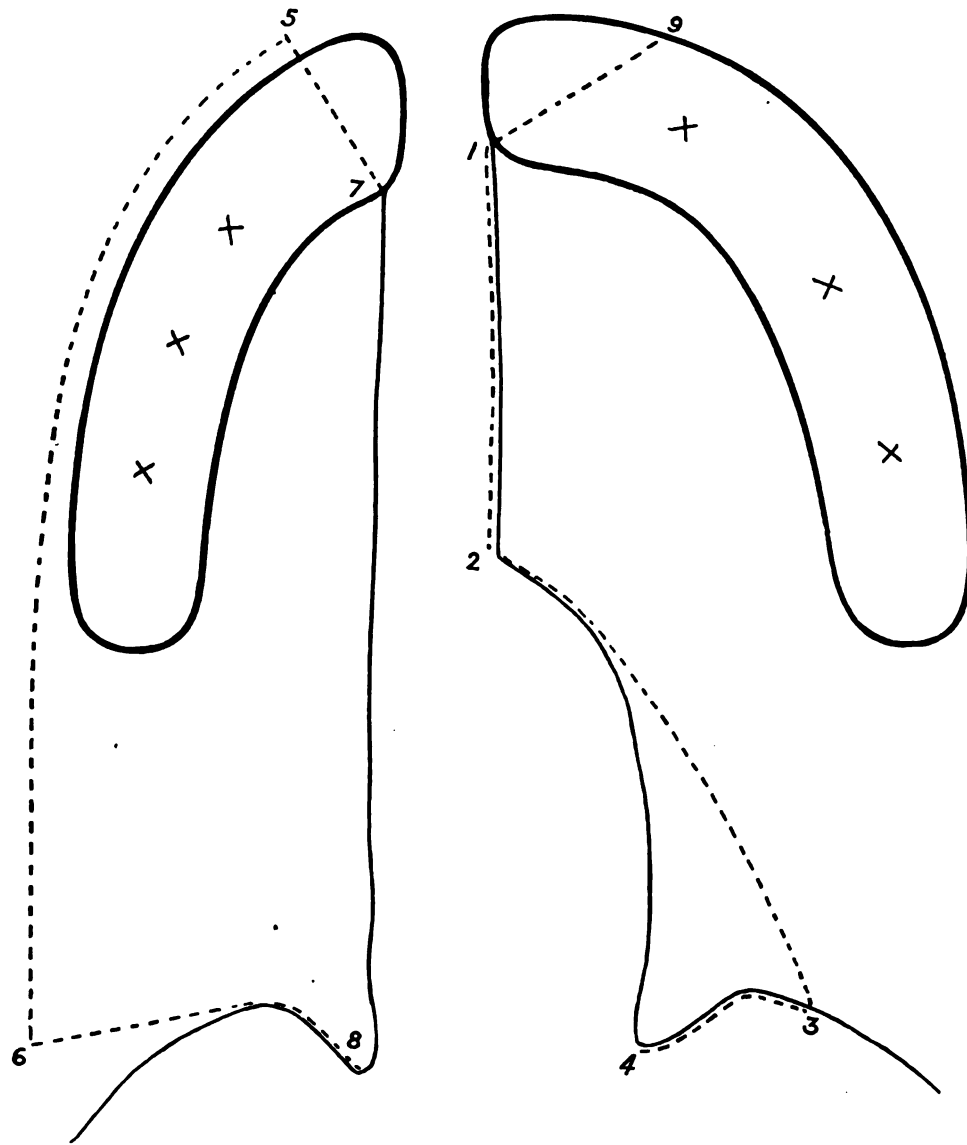


FIG. 38.—Flaps for a common type of cleft palate.

On the other side an incision is made from 9 to 1

along the edge of the cleft to 2, along the upper aspect of the soft palate to 3, and from 3 to 4.

The triangular area of mucous membrane and submucous tissue included within the triangle of flap on the upper surface of the soft palate is reflected inwards to the free margin of the cleft, while the muco-periosteum is raised from the bone by an elevator and scissors, introduced through the incision 1 to 2. The reflected flap is then placed beneath the elevated flap, and is retained firmly in position by a double row of interrupted sutures.

Fig. 39 shows the flaps sutured firmly in position. Along 9 to 4 are indicated the deep sutures which pass through the margin of the reflected flap and perforate the superjacent elevated flap, while those along 1, 2, and 3 represent the superficial sutures uniting the edge of the elevated flap to the adjacent under-surface of the reflected flap. Along 3 to 4 the posterior free margins of the reflected flaps are shown joined by sutures.

Should the cleft involve only the soft palate, as is shown in Fig. 40, the same method can usually be applied.

The uvula on the left side of the diagram is pulled forwards so that the upper surface of the palate is exposed, and an incision is made from 1 to 2 to 3 to 4,

through the mucous membrane and submucous tissue,

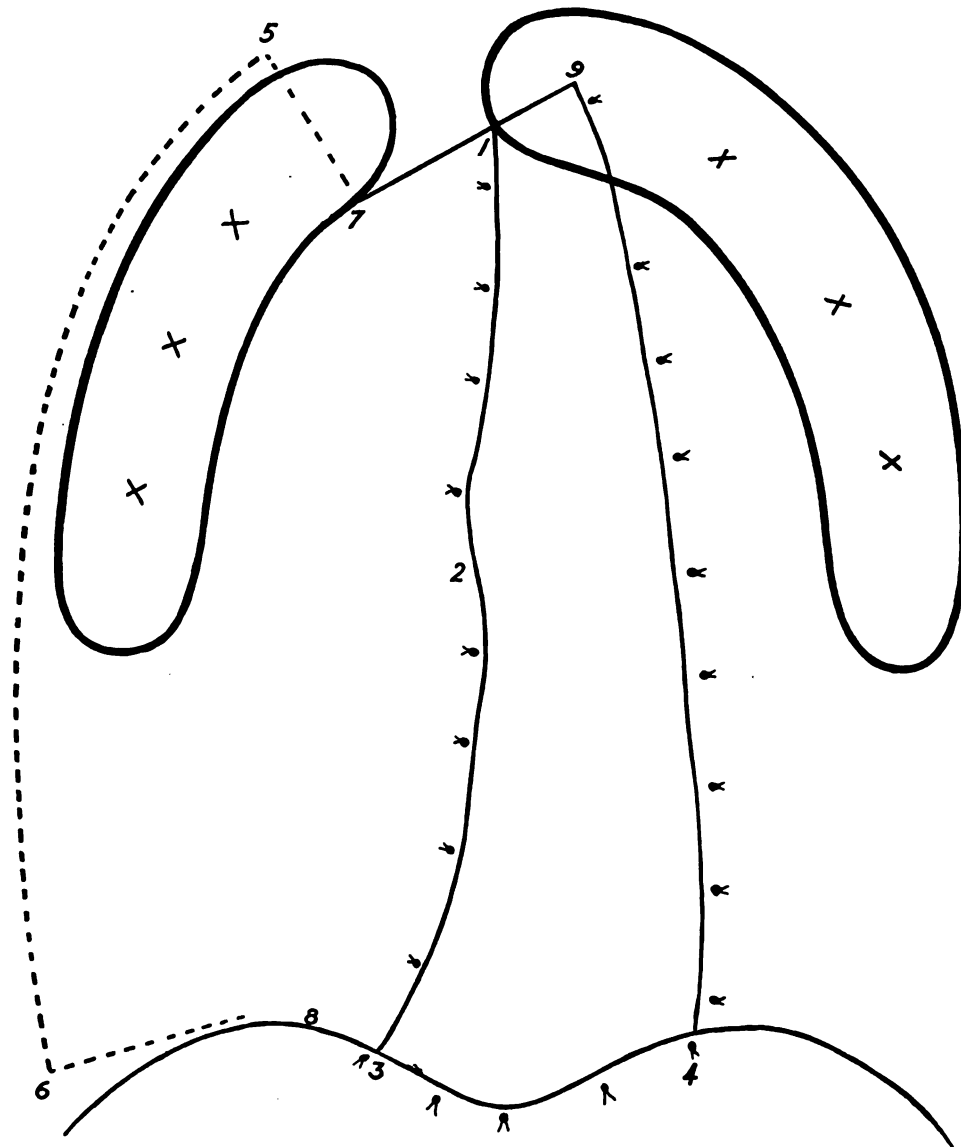


FIG. 39.

which are dissected off the subjacent parts inwards to the margin of the cleft.

From the area of the soft palate corresponding

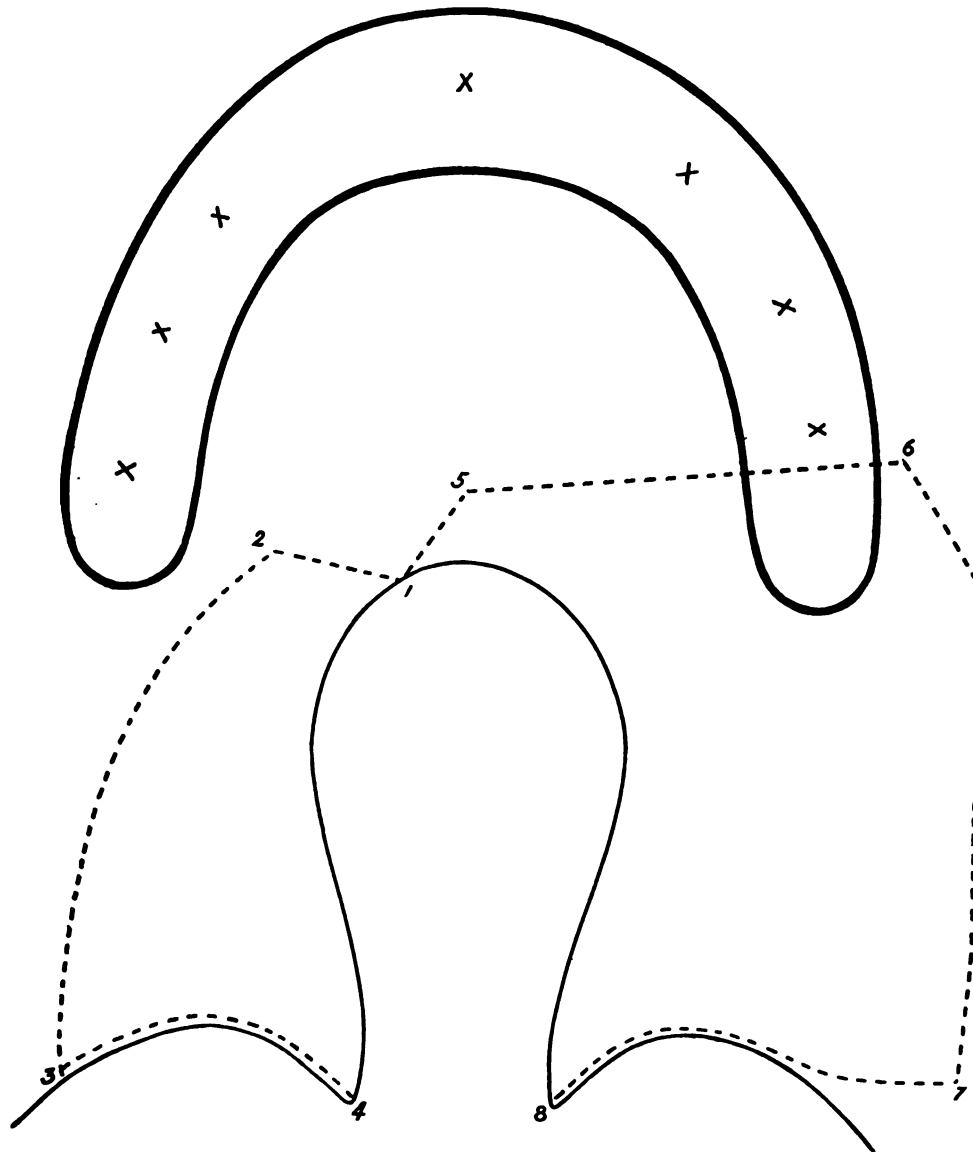


FIG. 40.

to the right portion of the diagram a flap is raised from its under surface by an incision from 1 to 5 to

6 to 7 to 8, and is reflected inwards to the margin of the cleft.

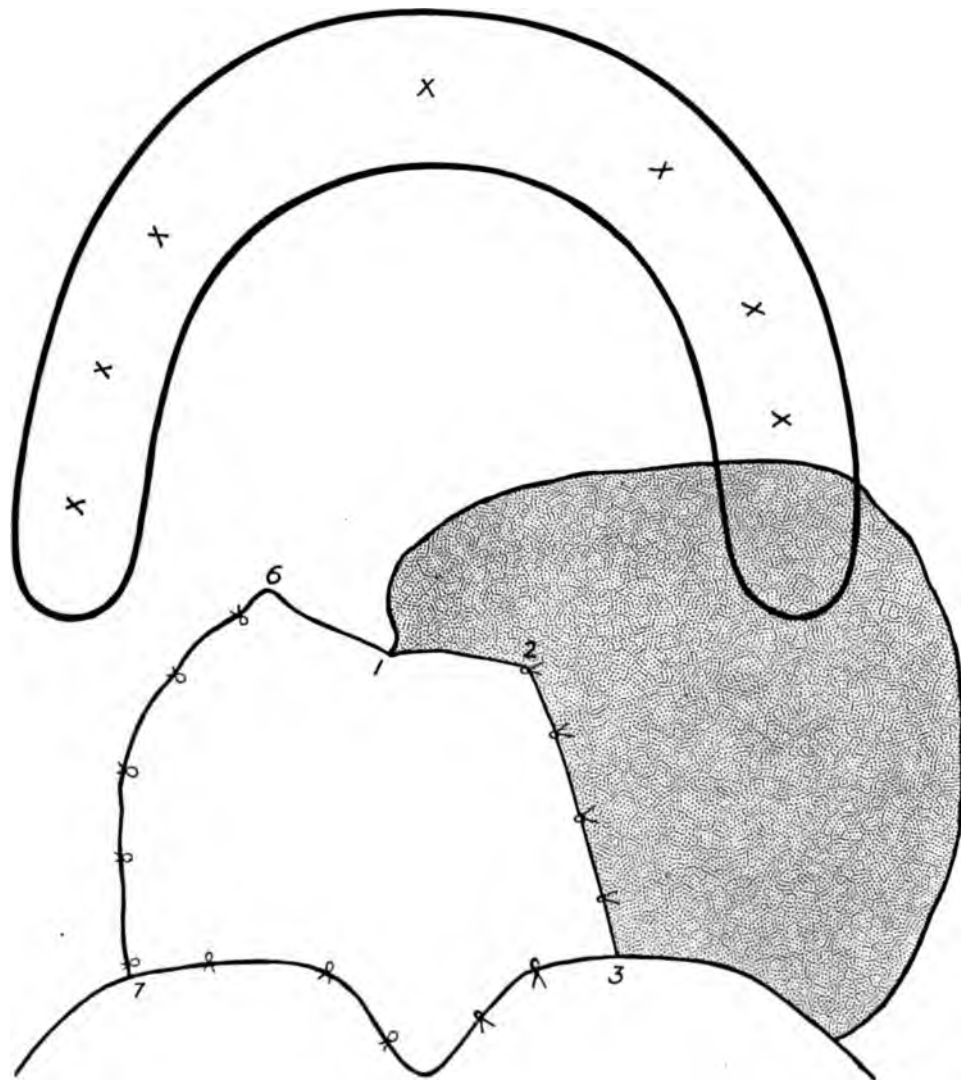


FIG. 41.

Fig. 41 shows the flaps sutured firmly in position, the darkened area representing the portion of the

palate left uncovered by mucous membrane. The deep sutures uniting the edge of the flap obtained from the under surface of the palate on the right side

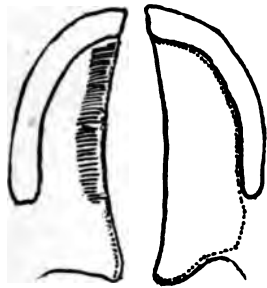


FIG. 42.—A complete cleft of the palate. The dotted lines indicate the incisions, and the shaded area the portion of muco-periosteum elevated from the subjacent bone.

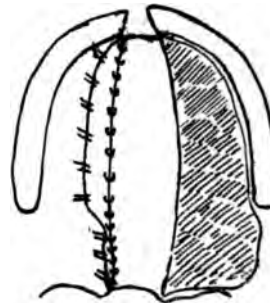


FIG. 43.—The flap fixed in position by a double row of sutures. The shaded part shows the surface of hard palate stripped of muco-periosteum.

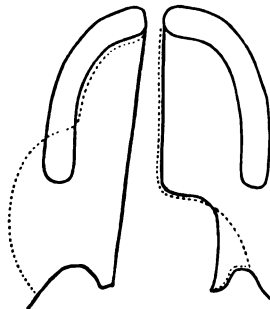


FIG. 44.—This represents a common form of cleft, in shape like a Queen Anne chair in profile. The dotted lines on the nasal aspect to the right of the cleft and on the buccal aspect to the left of the cleft indicate useful incisions.

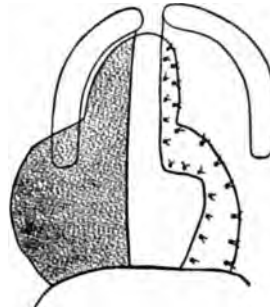


FIG. 45.—The flap in Fig. 44 in position and sutured.

to the raw upper surface of the palate on the left side are indicated between 6 and 7, while along 1, 2, and 3 are shown the sutures connecting the edge of the

flap reflected from the upper surface of the left side of the palate to the raw under surface of the palate on the right side. Between 7 and 3 are the sutures connecting the posterior free edges of the flaps. The terms right, left, refer to the diagram and not to the body. I would point out that within a fortnight or three weeks any raw surface left becomes so perfectly covered in by new tissue as almost to defy differentiation from the adjacent mucous membrane.

Figs. 42, 43, 44, and 45 represent, diagrammatically, conditions of cleft palate where the presence of teeth have rendered a complete flap impossible, or or where a sufficient flap can be obtained without encroaching on the gum.

The application of the combination of reflected and pivoting flap is well illustrated by Fig. 46.

This is intended to represent a double cleft palate with the premaxilla (PM) lying well in front of the level of the alveolar arch and fixed to the under surface of the tip of the nose, L being the small mesial segment of lip fixed to the anterior surface of the premaxilla. This is shown in Fig. 47.

The reflected flap is obtained by an incision extending from 1 along the outer aspect of the alveolus, through 2, and on to 3, when it bends inwards along the free margin of the soft palate to the uvula 4.

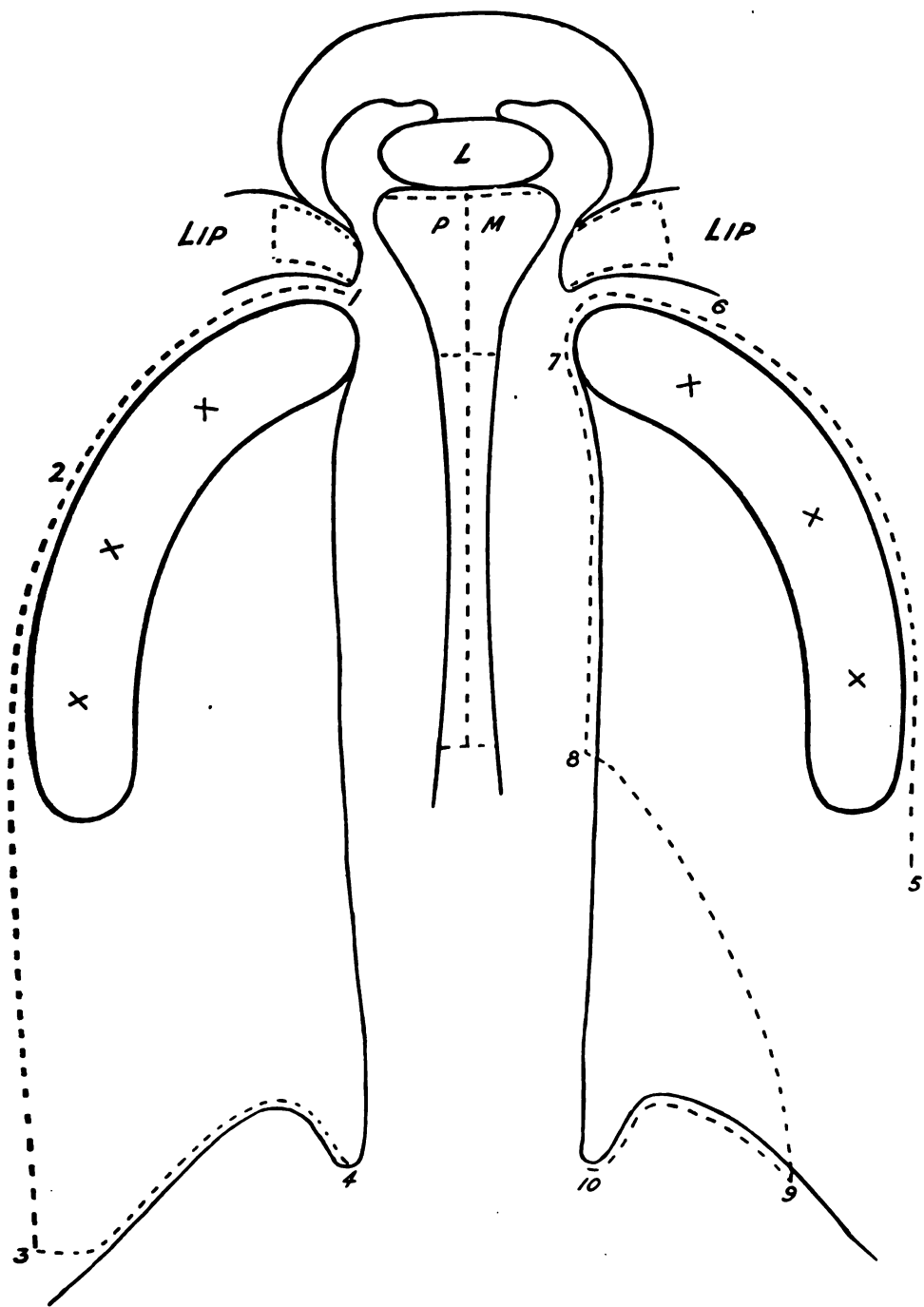


FIG. 46.

The pivoting flap is obtained by an incision from 5, along the outer aspect of the alveolus, through 6, along the margin of the cleft in the hard palate from 7 to 8, along the upper surface of the soft palate to 9, and then to 10.

The area of mucous membrane corresponding to the triangle 8, 9, and 10, is raised and reflected inwards.

The area of muco-periosteum included in 5, 6, 7, and 8 is raised from the subjacent bone, except at the



FIG. 47.

point of entry of the posterior palatine vessels and nerves, which form the pivot on which this flap rotates. The mucous membrane is stripped from the pre-maxilla and from the free edge of the septum in the manner indicated by the dotted lines, showing incisions in the diagram.

Large flaps are cut from the portions of lip forming the edges of the cleft, and great care is taken that they have an extensive attachment at their bases.

The mucous membrane covering the lateral and

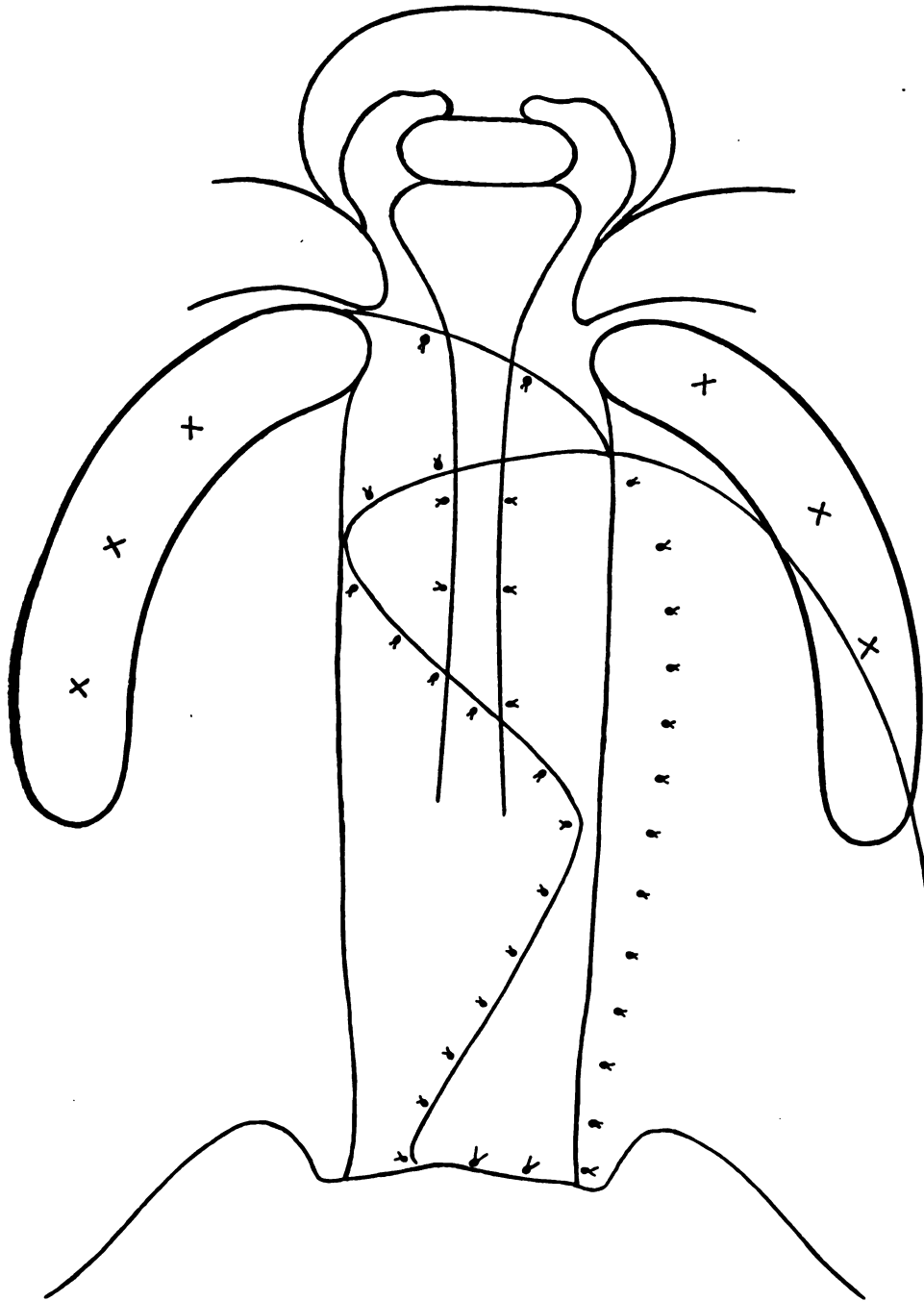


FIG. 48.

lower aspects of the piece of lip lying in the front of the premaxilla is removed (L).

The reflected flap is first put in position, the mucous membrane, where it comes into contact with the under surface of the septum, having been rendered

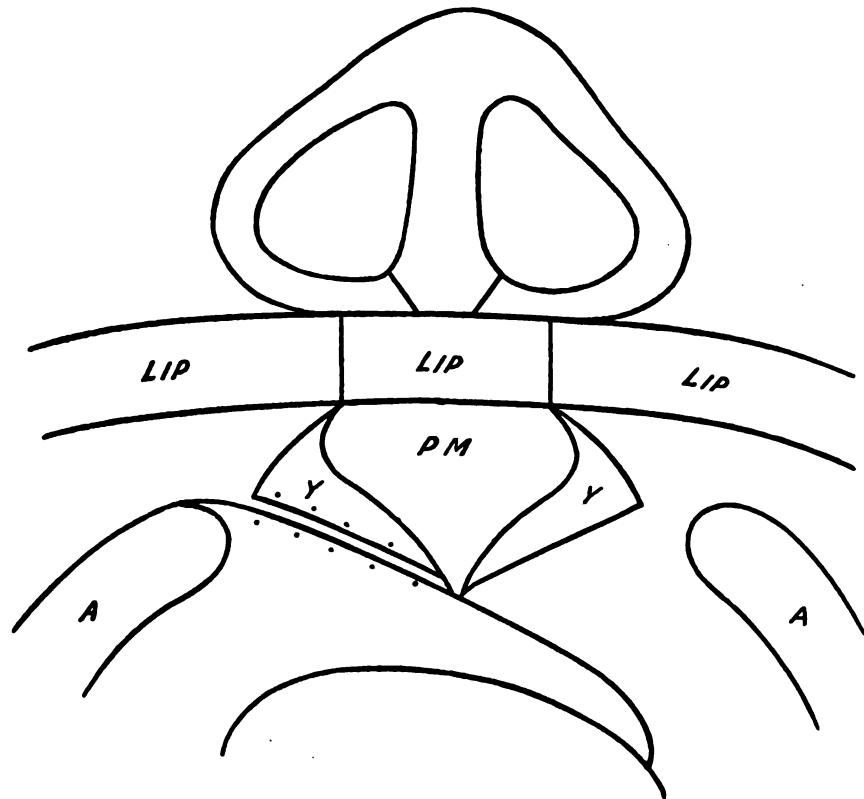


FIG. 49.

raw, is secured to it by sutures. The pivoting flap is then moved inwards upon the reflected flap, to which it is united firmly by a double row of sutures. Finally the soft palate is closed in a similar manner. This is represented in Fig. 48.

After this the triangular areas of muco-periosteum which were reflected from the premaxilla are fixed in position (see Fig. 49), where these are indicated by Y. The flaps from the lips shown as F F are arranged with their raw surfaces upwards. These are united

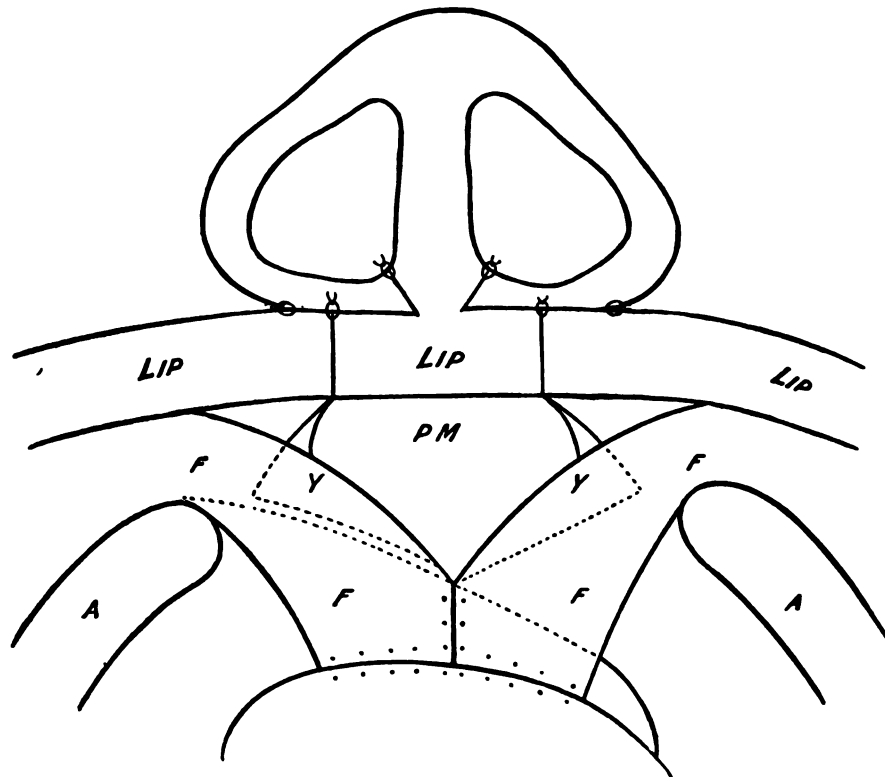


FIG. 50.

to the raw surfaces of the flaps from the premaxilla and of the reflected flap, and are also sutured by their margins to one another and to the free edge of the pivoting flap (see Fig. 50).

Lastly, the ala of the nose is cut away from the

cheek on either side, and is displaced inwards where it is united by sutures to the septum, and is sewn to the cheek in its new position. This I have attempted to indicate in the same diagram. Having brought the edges of the lip into accurate apposition by means of separate sutures, two sutures of linen thread

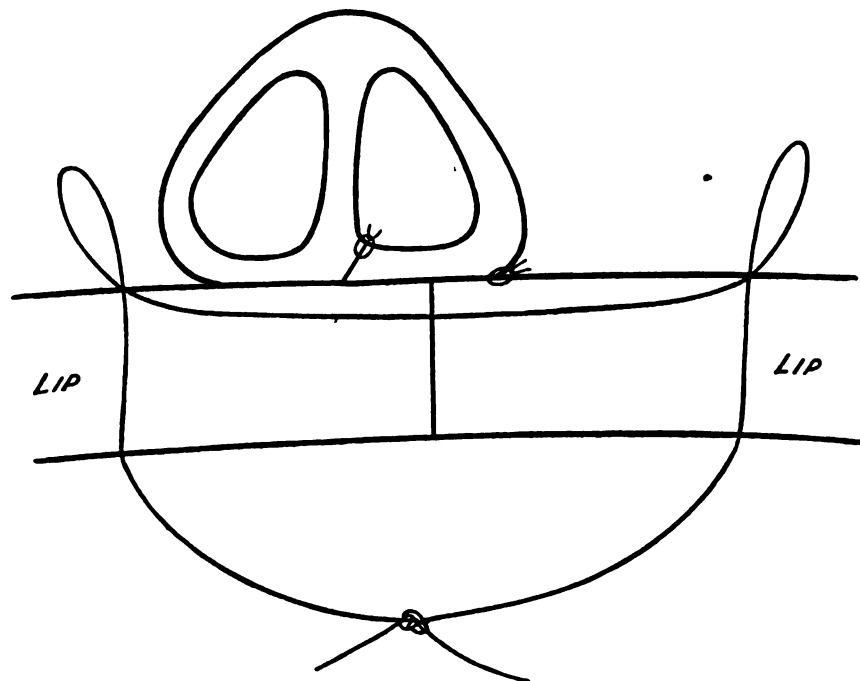


FIG. 51.

are passed in the manner indicated in Fig. 51. The needle perforates the lip from behind, and is made to re-enter the anterior aspect of the lip through the same hole, and after traversing the lip transversely it again emerges and enters through the same hole, the needle passing directly backwards through the lip.

When this thread is made taut and tied the opposing raw surfaces of lip are held in accurate apposition, and no scar whatever results from the presence of these deep sutures, which can be readily removed when they have served their purpose. In Fig. 51 only one cleft in the lip is represented.

Occasionally in clefts involving the soft palate, with probably a proportion of the hard palate, the soft parts forming the anterior two thirds of the margin of the cleft are as thin as paper. In such circumstances the splitting of the flaps can only be effected up to a considerable distance from the free margin, or some means other than splitting must be adopted. In splitting a thin flap there is a risk of a failure of nutrition of a part of it, so that a hole remains at the anterior limit of the cleft. An aperture in this situation is often very difficult to close. I have met this difficulty most effectually by dealing with the cleft in a manner which at first sight appears to be more complicated than it really is. The object is to employ a large flap whose vitality is of a very high order, and this is insured by its containing the descending palatine vessels and nerves of one side.

Fig. 52 shows a cleft involving the soft and part of the hard palate. On the left half of the diagram an incision represented as a dotted line commences

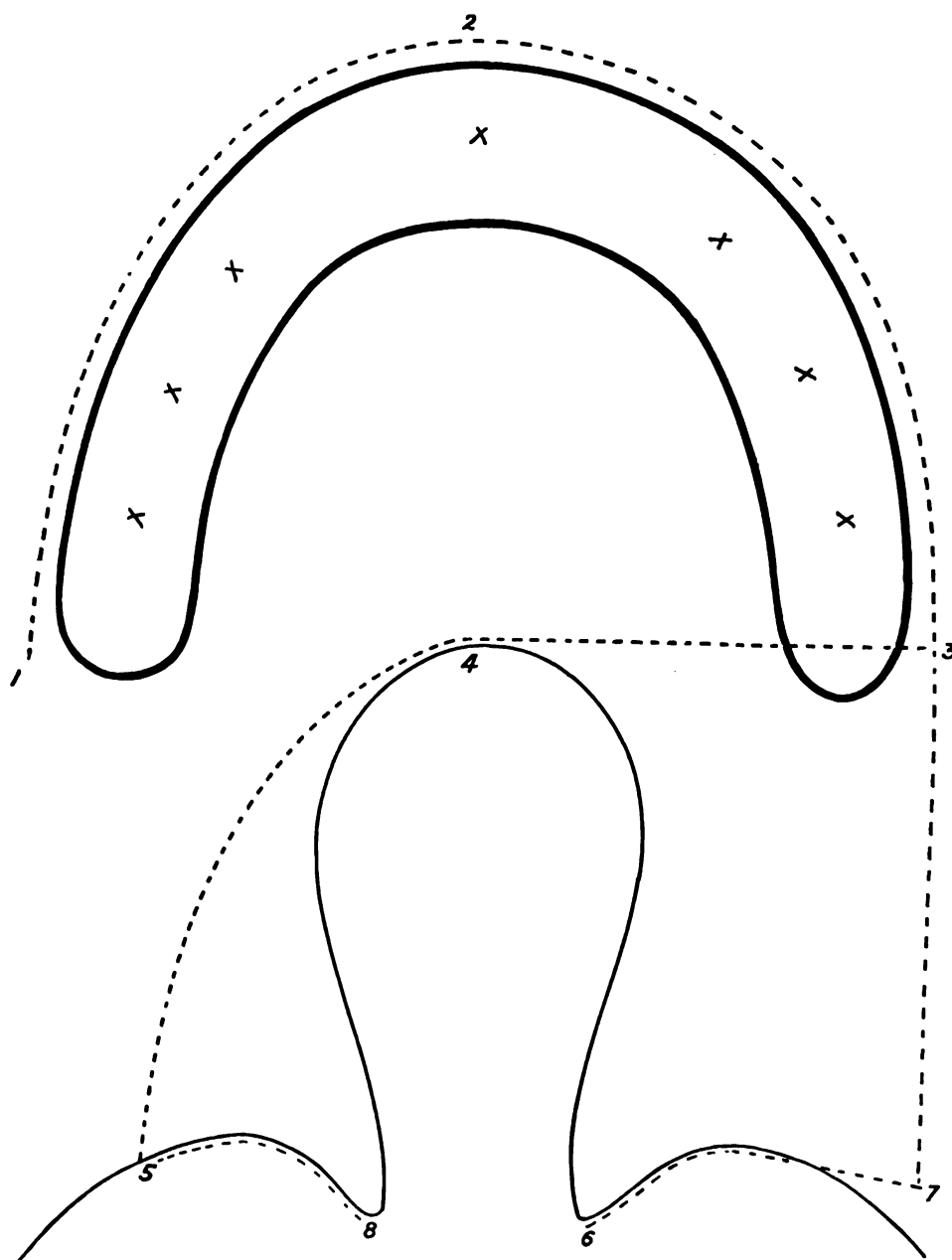


FIG. 52.

at 1 well outside, and behind the aperture through which the descending palatine vessels emerge. From that point it is carried forwards along the alveolar margin across the middle line 2 and along the alveolar margin of the opposite side to 3. It then extends along the outer limit of the soft palate to 7 and along its lower free margin to 6. An incision is carried outwards and slightly forwards from the anterior limit of the cleft 4 to meet the first incision at 3, and another from 4 along the upper surface of the palate to 5, and from 5 along the free edge of the palate to 8.

The four-sided flap of the soft parts forming the anterior surface of the palate included between the lines 4, 3, 7, and 6 is raised and reflected inwards to the free margin of the cleft. The large flap 4, 3, 2, 1, containing the vessels and nerves is elevated from the hard palate, and is separated from the margin of the cleft in the hard palate. The triangular area of mucous membrane included between 4, 5, and 8 is reflected inwards from the upper surface of the soft palate to the margin of the cleft so as to leave a raw area of considerable size.

The free edge of the quadrilateral reflected flap of soft palate 4, 3, 7, 6 is pinned by deep, indicated as 1 to 2, sutures to this bare surface so that sufficient

areas of the raw surfaces on either side are brought securely into accurate apposition (see Fig. 53).

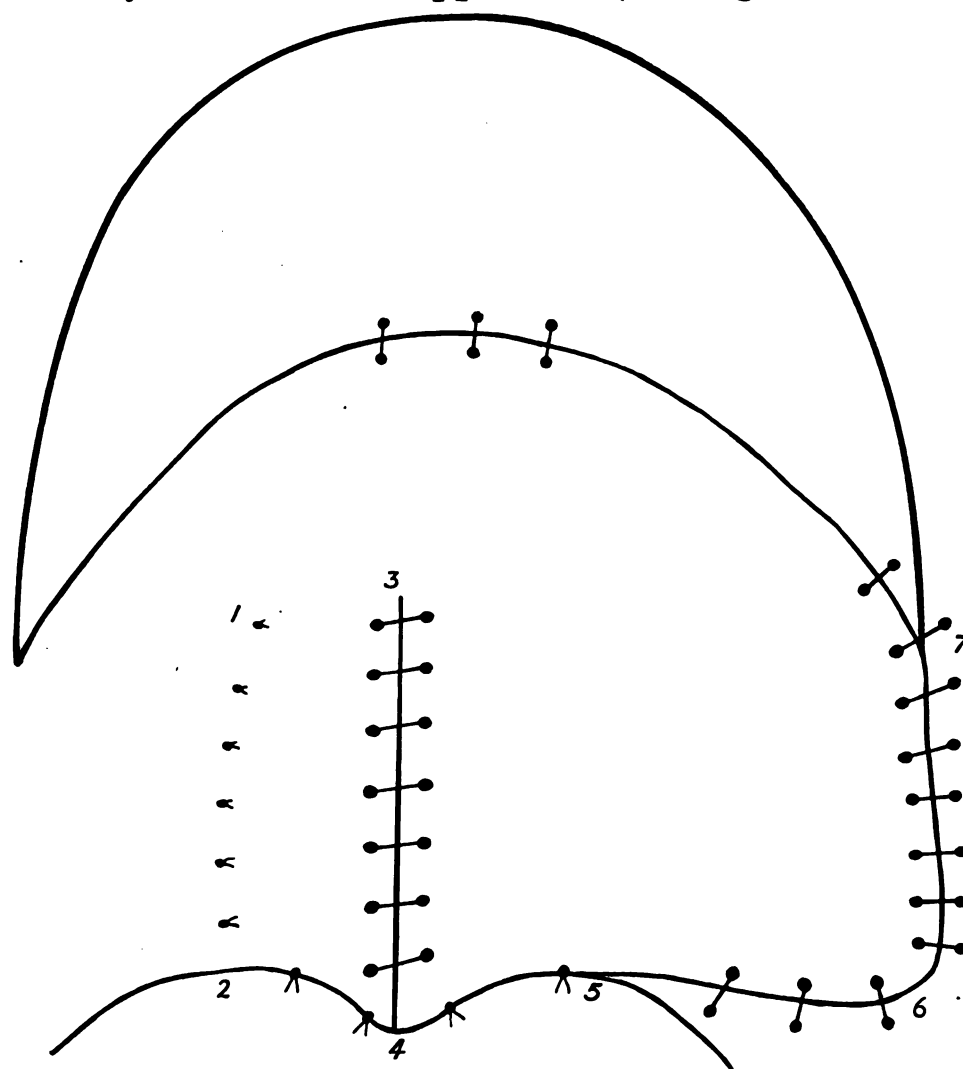


FIG. 53.

The large flap is then buckled up so that its lower margin comes into apposition with the free margin of soft palate on the same side. These edges are then

retained in apposition by sutures which also perforate the surface of the subjacent reflected quadrilateral flap. This junction is represented along the line 3 to 4.

The remaining free edge of the large flap is then sutured to the lower edge of the soft palate 2, 4, 5, 6, and to the outer limit of the quadrilateral incision 6 to 7.

It happens occasionally that it is impossible to close the whole length of the cleft by one single operation.

Fig. 54 illustrates such a condition. The cleft is a very wide one, and it is found inadvisable to attempt to close it by the reflection of flaps in the manner already described. An incision is made along the entire outer aspect of the gum along the line indicated 1, 4, 4, 4, 4. Two are made along the direction of 2, and two others along the free inner margins of the cleft along dotted lines 3, 3. Flaps are also separated from the septal margin.

The flap included between 1 and 2 on either side is turned back, great care being taken of its posterior attachment, which is usually very thin. The flaps comprised between 2, 3, and 4 are raised from the bone from before backwards, care being taken to avoid any damage to the descending palatine vessels. These flaps are then displaced inwards, as in Fig. 55,

upon the subjacent reflected flaps 3, 4, 5, 6, the margins of which are united by sutures to the super-

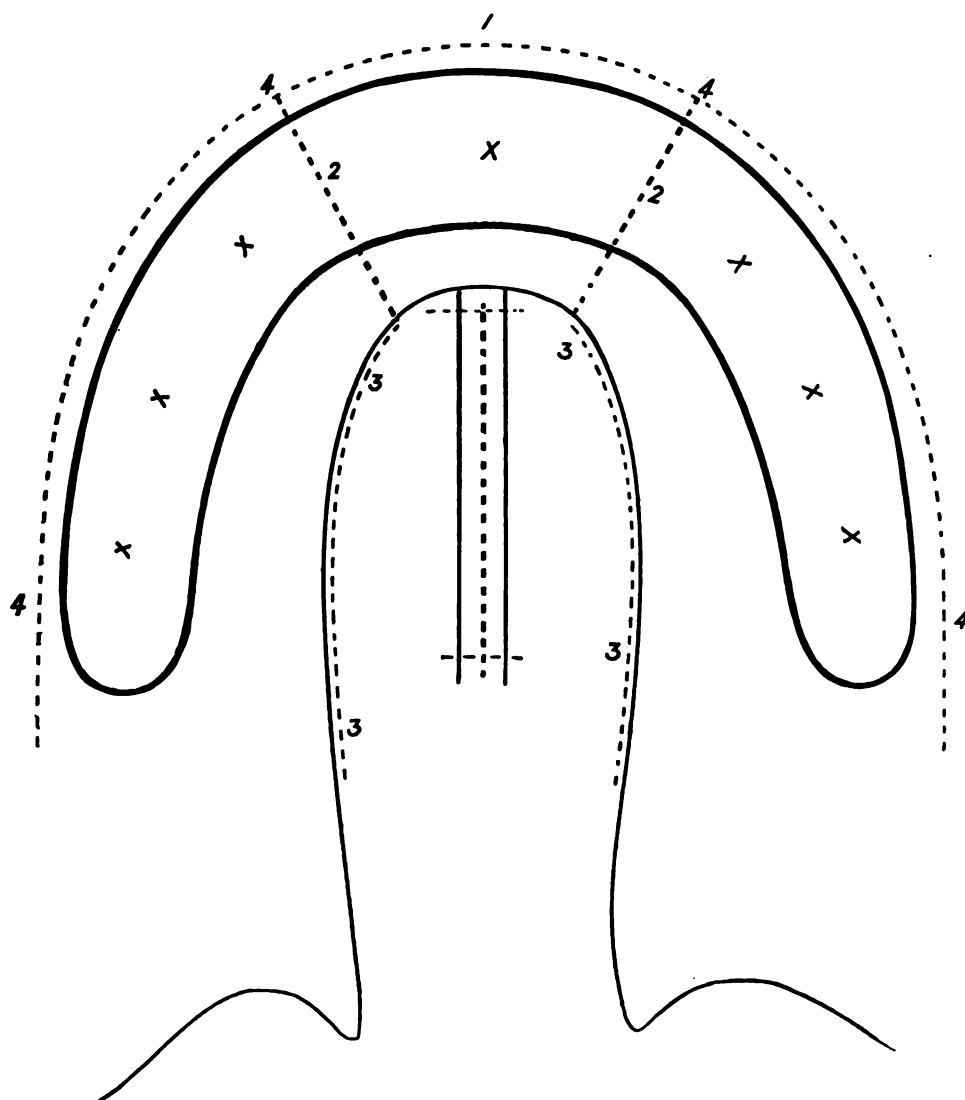


FIG. 54.

jacent pivoting flaps 1, 2, 7, 8. The apposing margins of the pivoting flaps are then sutured

together and to the subjacent mesial flap, and if possible to the septum also along the line 1, 2.

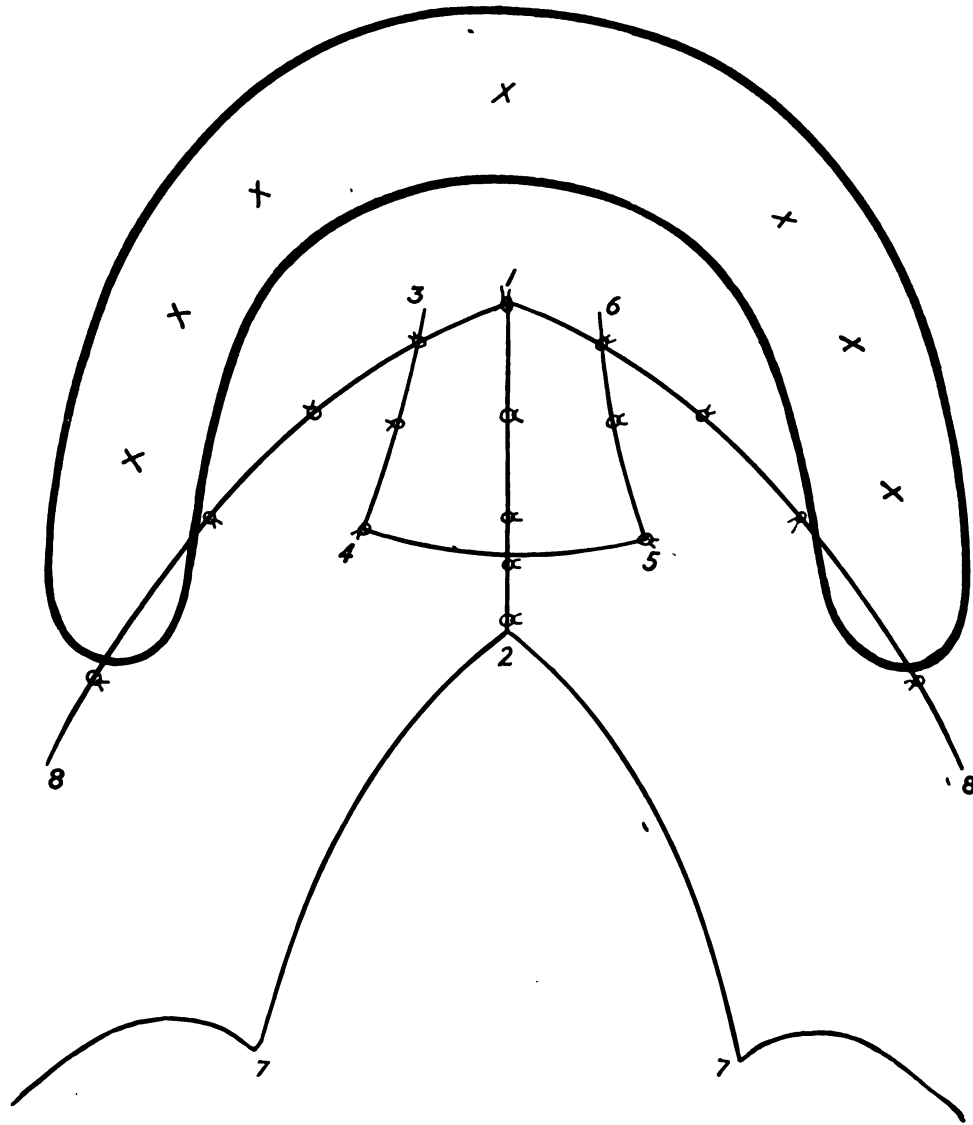


FIG. 55.

At a later period the posterior portion of the cleft may be closed in various ways, the method vary-

ing with the breadth of the cleft and the extent of material at disposal. The first and more generally

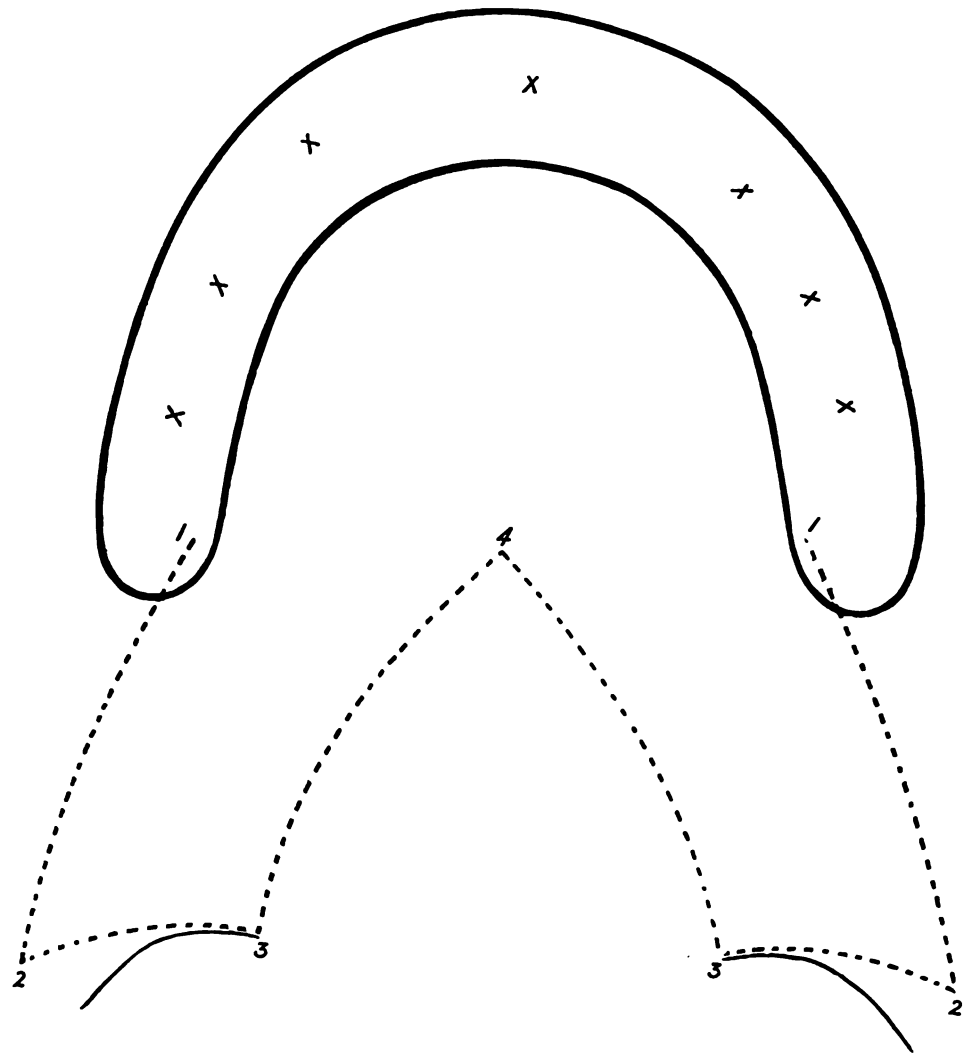


FIG. 56.

applicable method is by reflecting a flap inwards on one side, leaving it attached by its inner margin, the other flap being rendered raw on its posterior surface

and its area extended, as in Figs. 40 and 41. The second method is to reflect a flap inwards as before, while the flap from the opposite side is raised from

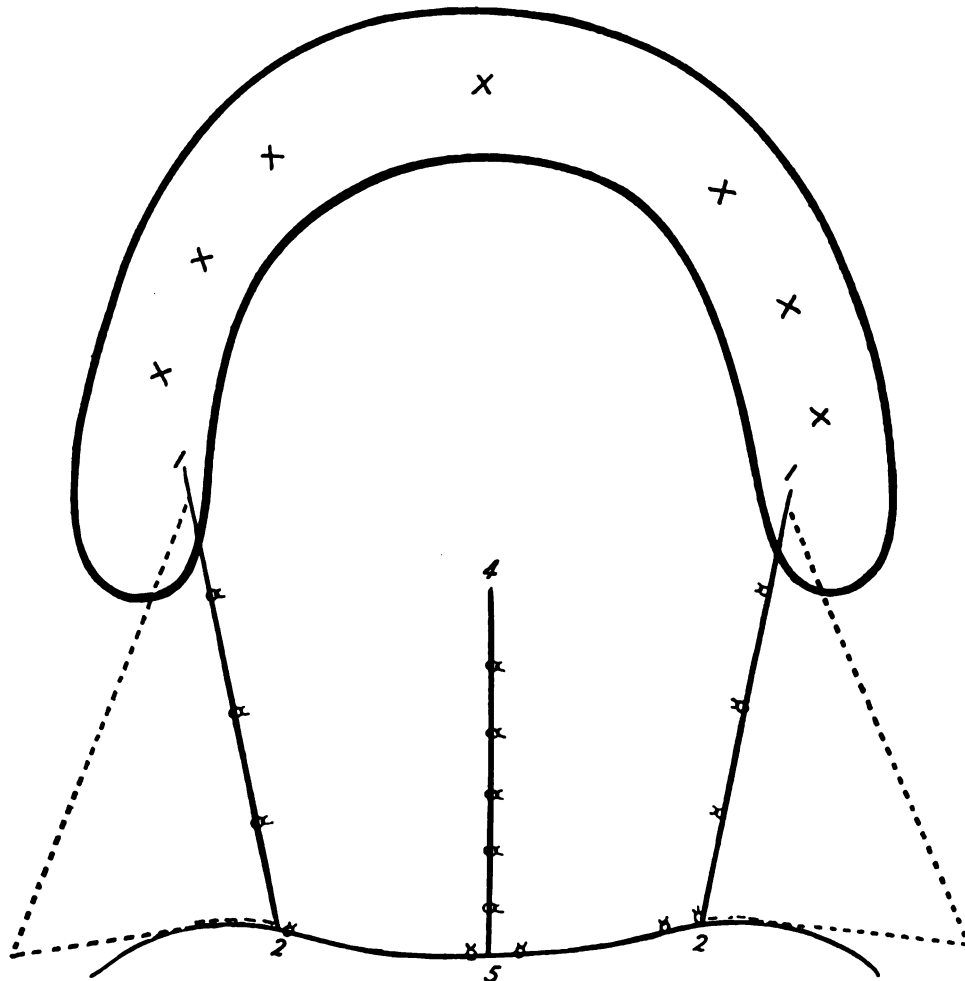


FIG. 57.

the subjacent parts by an incision extending along its inner, posterior, and outer margins, so that it pivots anteriorly, and can be made to cover the flap reflected

from the opposite side. Or both flaps may be made, as in Fig. 57, to pivot upon their anterior attachments, their internal edges are sutured carefully together, the outer free margins being anchored wherever a suitable attachment can be found. The free inner margins of the cleft are also pinned down to the superjacent flaps by sutures not shown in Fig. 57.

In Fig. 56 the dotted outline 1, 2, 3, 4 represents the form of the flap cut from the under surface of the palate. This pivots upon its attachment 1, 4.

In Fig. 57 these pivoting flaps are shown in apposition along the line 4, 5, where their edges are united to one another. Their outer margins are united to the exposed surface of soft palate along the line 1, 2.

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